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FACIAL EXPRESSION RECOGNITION USING VECTOR MACHINES

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Abstract-- *In Our Paper basically focuses on Facial Expression Recognition using some features i.e., Global and Local. Facial expression recognition plays an important role in communicating the emotions and intentions of human beings. Facial expression recognition in uncontrolled environment is more difficult as compared to that in controlled environment due to change in occlusion, illumination, and noise. The experimental results show that the performance of the proposed framework is better than existing techniques, which indica te the considerable potential of combining geometric features with appearance-based features. The major drawback with previously available techniques in literature is that they do not take finer details into account along with global geometric features.*

Keywords—*Python, Machine Learning, Facial expression recognition*

I. INTRODUCTION

Face plays an extremely important role in social communication, and so are facial expressions. Facial expressions can not only reveal the feelings or their sensitivity but can also help in judging other people's mental views. Facial expression recognition is a technique in which software tries to read the facial expressions of the human face using very advance image processing. Companies are doing experiments combining sophisticated algorithms along with image processing. This has been going around for around 10 years to get a major understanding about the feelings of a person using a simple image or a video of a person. This method is used to recognize expressions of a person. Many techniques have been put forward to detect expressions like happiness, sadness, anger, neutral, disgust, surprised etc.

A person's facial expression tells us best about his or her emotional status. If we can understand one's facial expressions then we can easily understand their emotions. Using these emotions, we can easily hack into the advancement whether it is in the social or business sector. Emotions cause a person to act the way they do or from business perspective makes them buy or purchase items. In fact, studies by the neuroscientist Antonio Damasio found that people who have a damaged part which triggers emotions have a hard time dealing with situations and also find it extremely difficult to make decisions. Many big companies use strategies to get most out of the people's emotions.

II. UNDER STANDING FACIAL EXPRESSIONS

Generally, a face is a structure of bones, muscles and tissues, facial hair, etc. When we smile or laugh or cry different muscles and tissues bend of turn in different ways so distinguished features are produced. Facial expressions can convey so much information without even saying a single word. There are different types of facial expressions such as:

Anger: It is an emotion that involves a strong uncomfortable and hostile response to a perceived provocation, hurt.

Contempt: It is an emotion which signifies that a person or a thing is worthless or beneath consideration.

Disgust: It is an emotion which involves a feeling of revulsion or strong disapproval aroused by something unpleasant or offensive.

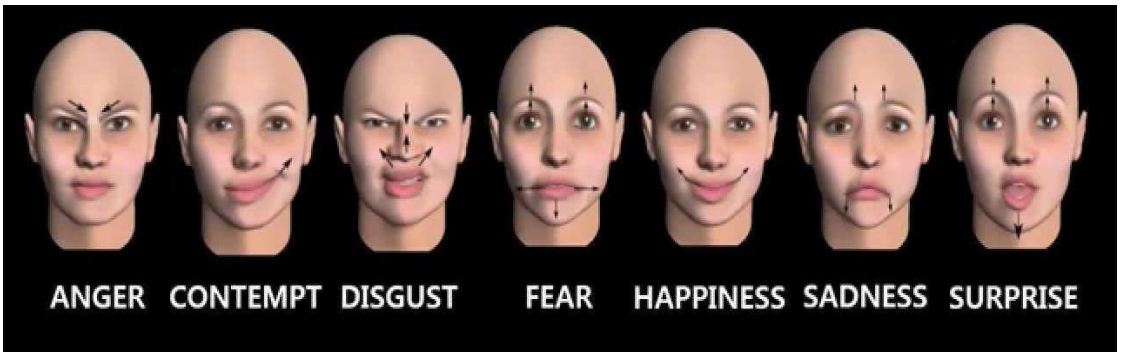
Fear: It is a feeling induced by perceived danger or threat that occurs in certain types of organisms.

Happy: Feeling or showing pleasure or contentment.

Neutral: It is an emotion which signifies when your face is relaxed and visibly devoid of any emotional expressions.

Sadness: Sadness is emotional pain or characterized by, feelings of loss, despair, grief, helplessness, disappointment, and sorrow.

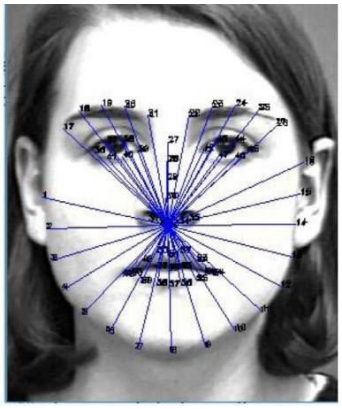
Surprise: It is an emotion that depicts an unexpected event.



III. METHODOLOGY

Happy, fear, surprise, anger, disgust, surprise, are six basic facial expressions, and is common across almost every different culture. This generally involves three steps that are face detection, feature extraction and classification of expression.
Basic steps for facial recognition are:

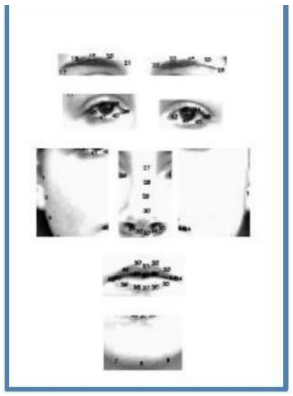
- **Face Detection and landmark plotting:** The first step for facial recognition is face detection. Different steps are involved in converting an image to a pure facial image for extraction of features is to detect various feature points, rotate to line up, locate and crop the face region by using a rectangle. 68 landmark points which are plotted on the human face are detected. These 68 landmarks are used in calculating the feature vectors for both region and global extraction.



- **Feature extraction:** It converts pixel data to higher-level representation of motion, shape, texture, color, and spatial configuration of face components. It reduces the dimensions of the input space. But the most important thing is that the reduction procedure must retain essential information, which is very important for pattern recognition system.

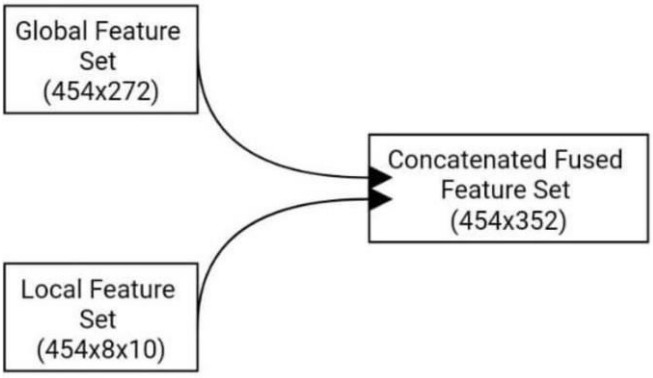
- **Global feature extraction:** For Extracting global features, a vector that contains the distance and angle of each point from the mean point is computed. The distance is calculated by taking the difference between coordinate points and mean points on the other hand the angle is calculated by taking inverse tan of ratio between length of y-axis and x-axis between landmark and mean point.

- **Dividing the face into multiple regions:** The face is then divided in eight sub-parts with the help of priorly plotted landmark points. Each landmark point is utilized by various parts of the face and that plays a vital role in facial expression recognition. Figure down below shows facial image divided into various areas showing, mouth, eyebrows, eyes, chin and cheek regions. And these parts are divided into 8 sub images



- **Local features extraction:** Once the important and decisive regions are obtained, the local features are then extracted from these using LBP. The sub regions are then passed onto LBP descriptor in a preset order. For each region, the descriptor will take number of points, radius and image of sub region as an argument. In a single sub-region, for each image pixel of a sub-region, LBP value is computed using the given number of pixels from the given radius. Now each pixel of that region will have a LBP value which is associated with it and is then used for creating a histogram for each sub-region. This histogram will return 10 feature points for every sub-region and since each image has 8 sub-regions there will be a total of 80 feature points that are extracted from a single image.

- **Concatenation of feature sets:** Two or more feature sets are joined together in a vector form. One of the problems with the local feature extraction is that is might miss the local structure as the effect of the center pixel. Whereas since the landmarks are plotted using pre trained model in global extraction, there can be some error in positioning of landmarks. This error is handled by Concatenation.



- **Classification for FER:** SVMs are powerful for binary as well as multi-class classification. SVMs separate multiple classes by drawing the hyperplanes which is an optimal way for classification. The extracted features along with labelled expression is passed to the SVM classifier.
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IV. EXPERIMENTAL RESULTS

One CK+ dataset is used to evaluate Effectiveness of the proposed FER model. The model was trained and tested on the emotions by selecting extremely intense expression image form each of dataset. We will select 326 neutral frames and they are the first frames in all of datasets. We have also taken 28 frames for sadness, 69 frames of happiness, 59 frames of disgust, 83 frames of surprise, 18 frames of content, 25 frames of fear, 45 frames of anger. The dataset is divided into 70-30 ratio (70% for training and 30% for testing). Since the random 70-30 ratio of dataset is selected every time the classification is performed, the process is repeated over 30 times and the average accuracies are calculated.

Table Shows the comparative (LBP, Global and Fused dataset) weighted true positive (TP), false positive (FP), precision, recall and the F measure separately for 6 (disgust, happiness, anger, sadness, neutral, surprise), 7 (6 expressions + neutral), and 8 expressions (7 expressions + contempt) observed during testing.

V. CONCLUSIONS

In this paper, we have presented a bimodal emotion recognition system constructed on face expressions and upper body gestures. We have proposed two approaches: In the first approach, emotions are recognized from upper body gesticulations and facial expressions independently. In the second approach the extracted features from facial part and upper body parts are combined together to recognize emotion. We have found that approach 2 achieves higher recognition rate than approach 1. This shows that combination of two modalities will provide the benefit of achieving better accuracy than unimodal approach.In future, this work can be extended using deep learning and for images with pose & illumination variations. More number of subjects will be added to the database.

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